Review of Advanced approach in Minimal Connected Dominating set based Algorithm in MANET for Efficient Routing

Nimmi Gupta, Krishna Kumar Joshi

Abstract— A wireless ad hoc network is a notable type of network in which a collection of mobile nodes with wireless network interfaces may form a temporary network, without use of any fixed infrastructure or centralized control. The Dynamic Source Routing protocol (DSR) is a efficient routing protocol explicitly designed for multi-hop wireless ad hoc networks of mobile nodes. A connected dominating set (CDS) is used to reduce broadcast overhead in the network. In this paper, we have narrated the design of multi-hop routing in mobile ad hoc network with the help of MCDS.

Index Terms— Ad-hoc Networking, Distance Vector Routing, Dynamic Routing, Mobile Networking, Wire-less Networks.

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1 Introduction

The wireless ad hoc network is utterly self-organizing and self-configuring, need no existing network infrastructure. Network nodes communicate with each other to forward packet and allow communication over multiple hops that are not directly in range of wireless transmission of one another.The DSR and MCDS together nodes to dynamically discover a source route across multiple hops in the network to reach any destination in the ad hoc network.In designing multi hop routing protocol, we use DSR and MCDS technique to design a new approch routing protocol have very low overhead.This new protocol to be the case high reliability of delivering data packets in the MANET.

A Connected Dominating Set (CDS) is used to reduce Broadcast Overhead. A common source of overhead in a Mobile Ad hoc network comes from blind broadcasts.let us assume the worst case, nodes in a wireless ad hoc network rebroadcast all received broadcast messages. Nodes can receive multiple copies of the same message from more than one neighbor nodes. Therefore, reducing redundant broadcast messages can reduce channel bandwidth consumption and increase bandwidth efficiency. It is possible to significantly reduce the overhead by using the Minimal Connected Dominating Set (MCDS) approach to reduce the redundancy due to these Blind Broadcasts.

Ad hoc networks are characterized by multi-hop wireless connectivity, frequently changing network topology and the need for efficient dynamic routing protocols. We compare the performance of two prominent on-demand routing protocols for mobile ad hoc networks—Dynamic Source Routing (DSR) and Ad Hoc On-Demand Distance Vector Routing (AODV). A detailed simulation model with MAC and physical layer models is used to study inter-layer interactions and their performance implications. We demonstrate that even though DSR and AODV share a similar on-demand behavior, the differences in the protocol mechanics can lead to significant performance differentials. The performance differentials are analyzed using varying network load, mobility and network size. Based on the observations, we make Recommendations about how the performance of either protocol can be improved.

2 Types of Protocols

2.1 Topology Management Routing (Proactive or Table Driven) Protocols

Proactive Routing Algorithm maintains a routing table, which contains Next Hop information for each node, so routing path between source and destination is always available. Hence each node regularly maintains the complete routing information of the network. When a node required forwarding a packet, the route is without reluctance available. Distance Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP), Global State Routing (GSR) and Cluster Head Gateway Switch Routing (CGSR) are examples of Proactive Routing Protocols.

2.2 On-Demand Routing (Reactive) Protocols

Routing information is working on demand basis. This protocol is an inactive approach to routing. When a source desires to communicate to destination, it initiates the route discovery process for find the path to the destination. Route remains use till the destination is reachable.

2.3 Hybrid routing protocols

One of the important feature of AODV is use a destination sequence number for each route entry.The destination sequence number is created by the destination to be along with any route information it sends to requesting nodes.Using destination sequence numbers ensures loop freedom and is simple to programme.we have the choice between two routes to a destination, a requesting node is required to select the one with the greatest sequence number.

2.4 Dynamic Source Routing protocol (DSR)

The Dynamic Source Routing protocol (DSR) is a easy and well odered routing protocol designed explicitly for use in multi-hop wireless ad hoc networks of mobile network nodes. DSR allows the network to be completely self-organizing and for any existing network infrastructure or administration. The protocol is mixing of the two mechanisms of Route Discovery and Route Maintenance. The main feature of DSR is the use of source routing.where sender having the complete hop-by-hop route to the destination. These routes are stored in a route cache. The data packets having the source route in the packet header. When a node in the ad hoc network deliver to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically find such a route.

2.5 AODV

AODV shares DSR's on-demand characteristics in that it also discovers routes on a basis having a similar route discovery process. However, AODV adopts a very different mechanism to maintain routing information. It uses basic routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate a RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops.These sequence numbers are carried by all routing packets. An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is "expired" if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes that use that entry to route data packets. These nodes are notified with RERR packets when the next hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. In contrast to DSR, RERR packets in AODV are intended to inform all sources using a link when a failure occurs. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves. The recent specification of AODV includes an optimization technique to control the RREQ flood in the route discovery process.

3 Minimum Connected Dominating Set (MCDS)

Blind Broadcast in a Mobile Ad hoc network is a basic problem. Blind Broadcast in a wireless ad hoc network means, any wireless node will rebroadcast all received broadcast messages. One node may receive the same copy of a message from more than one Neighbor nodes of network. Hence, needless Overhead is introduced A Connected Dominating Set (CDS) is used to reduce Broadcast Overhead. A common source of overhead in a Mobile Ad hoc network comes from blind broadcasts.

3.1 Example Of MCDS

In a simple Graph G = (V, E) where V is the set of Nodes and E is the set of Edges Assume a node set T is subset of V such that for all 'X' in V-T, there exist 'Y' belongs to V, such that edge (x,y) belongs to E. This is the core property for a CDS (Connected Dominating Set). Set T is called a Connected Dominating Set (CDS) when T forms a Connected Graph. This is the Connectivity Property for a CDS. Below given Figure(i) gives an example of a CDS. Black Nodes 2 and 3 are connected and cover all nodes in the network. They form a CDS for this graph. Minimal Set of CDS is known as Minimal Connected Dominating Set (MCDS). Since in given example CDS is already minimal, hence MCDS includes node 2 and node 3.

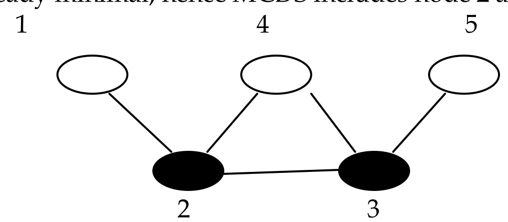

Fig (i): An example of MCDS

3.2 Algorithm I (Connected Dominating Set Approach)

This approach is a Greedy Algorithm for solving the MCDS Problem. The idea behind the algorithm is as follows: Grow a tree T, starting from the Vertex of the Maximum Degree. At each step, a vertex V in T is picked and scans it. Scanning a vertex, adds edges to T from V to all its neighbors not in T. In the end, it obtains a Spanning Tree T, and will pick the Non-Leaf Nodes as the Connected Dominating Set.Initially all vertices are unmarked (White). When a vertex is scanned (color it Black), all its neighbors that are not in T is marked and add them T (color them Gray). Thus marked nodes that have not been scanned are leaves in T (Gray Nodes). All unmarked nodes are White. The algorithm continues scanning marked nodes, until all the vertices are marked (Gray or Black). The set of scanned nodes (Blank Nodes) will from the Connected Dominating Set (CDS) in the end. A vertex is picked that has the maximum number of unmarked (White) neighbors.

In figure (ii a) and (ii b) Black nodes are obtained by using CDS algorithm I, and Gray nodes are Dominated nodes by Dominating Set. It is clear that no White nodes are left in the given graphs.

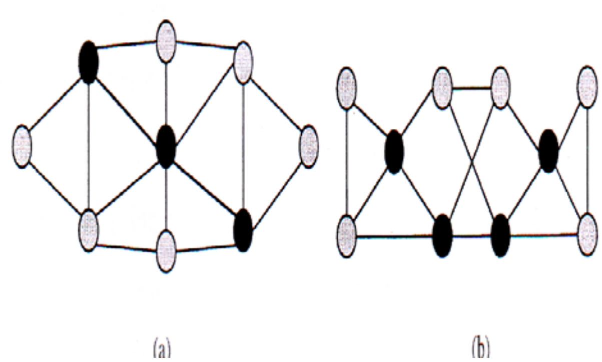

Fig (ii): An example of algorithm I

Using the scanning rule described above yield a connected dominating set of size at most 2 (1+H(Δ)). !OPTDS! Where, OPTDS is an optimal dominating set in the graph. An implementation required a worst case running time of O (mn2),

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where m is the number of edges and n is the number of vertices in the graphs

3.3 Algorithm II (Dominating Set Approach)

This algorithm is an improvement of the first algorithm. The algorithm finds a dominating set in the first phase and in the second phase connects the dominating set.
At the start of the first phase all nodes are colored white. Each time it include a vertex in the dominating set, it is colored with black. Nodes that are dominated are colored gray (once they are adjacent to a black node). In the first phase the algorithm picks a node at each step and colors it black, coloring all adjacent white nodes gray. A piece is defined as a white node or a black connected component. At each step we pick a node to color black that gives the maximum (non-zero) reeducation in the number of pieces.

In the second phase, it has a collection of black connected components that need to connect. Recursively connect pairs of black components by choosing a chain of vertices until there is one black connected component.

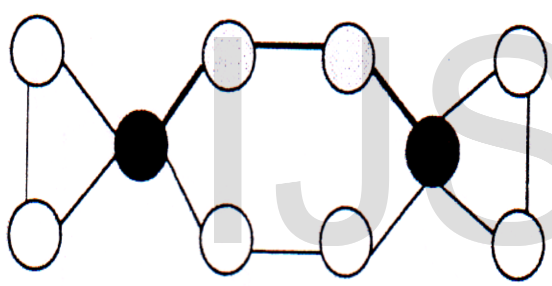

Fig (iii): An example of algorithm II

In figure (iii) black and gray nodes are generated by algorithm II in first and second phases respectively. Since black nodes are disconnected so gray nodes are needed to connect these black nodes. Hence CDS is both black and gray nodes.

The connected dominating set found by the algorithm is of size at most (In Δ +3). ! OPT CDS! Where, OPT CDS is an optimal dominating set in the graph. Am implementation required a worst case running time of O (mn2), where m is the number of edges and n is the number of vertices in the graph.

4 Literature Review

In paper [1] auther discussed about multi hop wireless Ad hoc network routing protocol Broach, D.A. Maltz, Ad-hoc On-Demand Distance Vector Routing, An adhoc network is the cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point or existing infrastructure.

In paper [3] auther discussed that Virtual backbone construction in multi hop Ad hoc wireless network B. Das, our new routing algorithm is quite suitable for a dynamic self-starting network, as required by users wishing to utilize ad-hoc networks. Our algorithm scales to large populations of mobile nodes wishing to form ad-hoc networks.

In paper [7] auther composed about Security threating mobile Adhoc network Wenjia Li Security Threats in Mobile Ad-hoc Network. The wireless nature of MANET gives the security to the designers, many types of attacks and system security, which means how to give security to the system, although security problems in MANETs.

In paper [5] auther says that Nirmala Chouhan, the design of multi-hop routing in mobile ad-hoc network with the help of MCDS. A performance comparison of Multi hop wireless Ad hoc network Routing Protocol. Due to the limited transmission range of wireless network interfaces, multiple networks "hops" may be needed for one node to exchange data with another across the network.

In paper [6] auther discussed about DSR by using MCDS for Ad hoc network Nirmala Chouhan,this paper presents the results of a detailed packet-level simulation comparing four multi-hop wireless ad hoc network routing protocols that cover a range of design choices DSDV, TORA, DSR, and AODV.

In paper [2] auther says that graph theory in MANET Natarajan Meghanathan We presents Ad-hoc On Demand Distance Vector Routing (AODV), a novel algorithm for the operation of such ad-hoc networks. AODV provides loop-free routes even while repairing broken links.

In paper [4] auther discussed that dominating set formation for wireless Ad hoc network. Mano Yadav, Multihop Routing with MCDS in MANETS: A connected dominating set (CDS) is used to minimize broadcast overhead.

In paper [8] auther Bipul syam purkayastha discussed that there is need to find the shortest path. The routing Protocol which gives the shortest path it gives more collisions and delay in between. In order to avoid all loss in performance and gives less chance to collision.

In paper [9] auther Perkins discussed that the DSR by using MCDS for Ad-hoc network.Blind Broadcast in a mobile Ad hoc network is a common problem one node may receive copy of message from more than on neighbor.

S.No	Year	Paper Title	Problem	Solution
1	1998	A performance comparision of multi hop wireless Ad hoc network routing protocol	Limited transmission range	Infrastructureless networking
2	2001	Introduction to graph theory in MANET	MCDS in a graph NP hard problem	communication range by selecting dominating

				node
3	2006	Virtual backbone construction in multi hop Ad hoc wireless network	Broadcast strom,global flooding	Virtual backbone structure
4	2009	Modified minimum connected dominating set formation for wireless Ad hoc network.	Complexity of network	Modified Bevan Algorithm
5	2011	Improved MCDS for Ad hoc network	Broadcast Overhead	MCDS Protocol efficient and communication range.
6	2012	Enhanced DSR by using MCDS for Ad hoc network	Blind Broadcast in a mobile Ad hoc network	CDS is used to reduce broadcast overhead
7	2012	Security threating mobile Adhoc network	Security problem in MANATS	Discover the active shortcut and best possible path
8	2012	Comparative analysis of routing attack in ad hoc network	Security attack such as blackhole attack	Secure routing protocol
9	2000	Performance Comparison of Two On-demand Routing Protocols for Ad Hoc Networks	The poor delay and throughput performances	generates less routing load than AODV

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5 CONCLUSION

To generate routes proactively or on-demand is extremely costly for energy and resource constraint nodes in a limited Bandwidth shared wireless channel. Communication by blind Broadcast that induces anintolerable overhead is not a feasible Solution. A MCDS is required for cost effective communication and maintenance of the route. It is therefore, proposed to restrict the routing process in wireless ad hoc networksthereby, to the formation of a MCDS. MCDS can reduce the communication overhead, increase the bandwidth efficiency reduce channel bandwidth consumption, decreases the energy consumption, increases network operational life, and provides better resource management. A connected dominating set is implemented as MCDS in Mobile ad hoc networks.

6 Future Work

Proposed Algorithms is not suitable for Dense Mobile Ad hoc network. It would be interesting to study that how such an approach could be developed for Dense Wireless Ad hoc networks.The proposed Algorithms belongs to Centralized Version. The Future works will extend the proposed algorithms to generate Maximum Independent Set based on Articulations Points and then formation of a Dominating Tree and so it can lead towards Localized Algorithms.

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- *Nimmi Gupta is currently pursuing masters degree in Computer Engineering in MPCT collage of RGPV University, India.*
- *E-mail: nimmigupta22@gmail.com*
- *Krishnakumar Jhoshi Assistant professor in MPCT Collage gwalior ,India E-mail: krishnakjoshi@gmail.com.*